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MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

GERT SIBANDE DISTRICT

NATIONAL
SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES

JUNE FORMAL TEST 2021

MARKING GUIDELINES

This marking guidelines consists of 13 pages

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

- 1.1 C ✓✓ (2)
- 1.2 C ✓✓ (2)
- 1.3 C ✓✓ (2)
- 1.4 A ✓✓ (2)
- 1.5 B ✓✓ (2)
- 1.6 D ✓✓ (2)
- [12]

QUESTION 2

- 2.1 1,5 s ✓ (1)
- 2.2 Equal distances travelled ✓ per unit time ✓ (2)
- 2.3 The total (linear) momentum in a closed system remains constant. (2)
- 2.4 $\Sigma p_i = \Sigma p_f$
 $(m_1 + m_2)v_i = (mv_f)_1 + (mv_f)_2$ } Any one ✓
 $0 = \underline{m(5) + (3m)v_f}$ ✓
 $v_f = -1,67$
 $v_f = 1,67 \text{ m} \cdot \text{s}^{-1}$ ✓
- (4)

[9]

QUESTION 3

3.1 Motion under the influence of the gravitational force **ONLY** ✓✓ (2)

3.2

3.2.1 $-9,8 \text{ (m} \cdot \text{s}^{-2})$ ✓ (1)

3.2.2 1 (s) ✓ (1)

3.3 **POSITIVE MARKING FROM Q3.2.1**

Upwards positive:

$$v_f = v_i + a\Delta t \quad \checkmark$$

$$\underline{-12,74 = 4,9 + (-9,8) \Delta t} \quad \checkmark$$

$$\Delta t = 1,8 \text{ s} \quad \checkmark$$

Downwards positive:

$$v_f = v_i + a\Delta t \quad \checkmark$$

$$\underline{12,74 = (-4,9) + (9,8) \Delta t} \quad \checkmark$$

$$\Delta t = 1,8 \text{ s} \quad \checkmark$$

(3)

3.4 $\Delta y = \text{area} = \frac{1}{2} bh \quad \checkmark$

$$= \frac{1}{2} (0,5)(4,9)$$

$$= 1,23 \text{ m} \quad \checkmark$$

(2)

3.5 **POSITIVE MARKING FROM Q3.2.1**

OPTION 1

3.5 **Upwards positive:**

$$v_f^2 = v_i^2 + 2a\Delta y \quad \checkmark$$

$$\underline{0 = 10,7^2 + 2(-9,8) \Delta y} \quad \checkmark$$

$$\Delta y = 5,84 \text{ m} \quad \checkmark$$

Downwards positive:

$$v_f^2 = v_i^2 + 2a\Delta y \quad \checkmark$$

$$\underline{0 = (-10,7)^2 + 2(9,8) \Delta y} \quad \checkmark$$

$$\Delta y = -5,84$$

$$\text{height} = 5,84 \text{ m} \quad \checkmark$$

(3)

POSITIVE MARKING FROM Q3.3

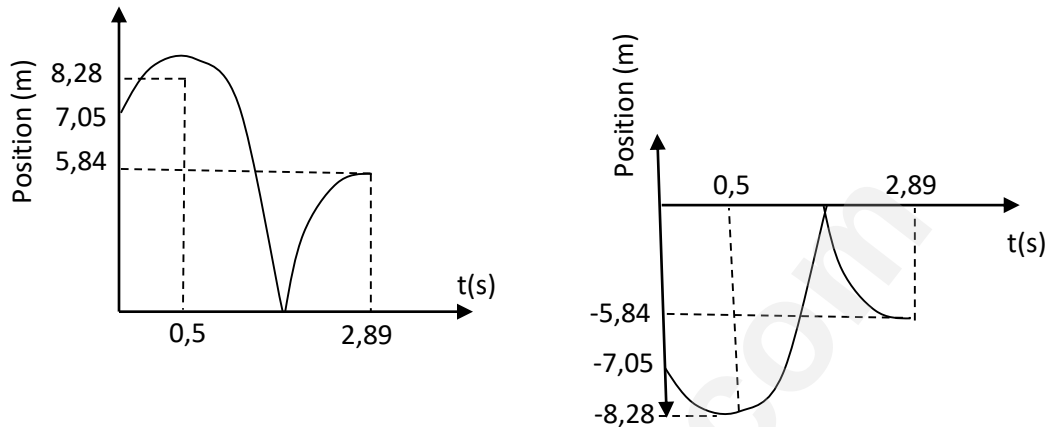
OPTION 2

$$\Delta y = \text{area} = \frac{1}{2} bh \quad \checkmark$$

$$= \frac{1}{2} (2,89-1,8) \checkmark (10,7)$$

$$= 5,83 \text{ m} \quad \checkmark$$

3.6 3.6



CRITERIA: POSITIVE MARKING FROM Q3.4 AND 3.5

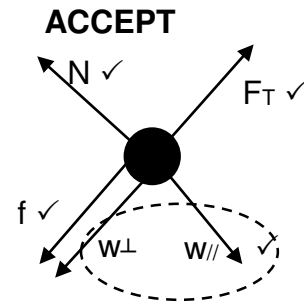
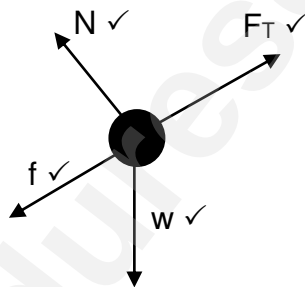
y-intercept as 7,05 m	✓
Position at $t=0,5$ s as $(7,05 + \text{answer Q3.4})=8,28$ m	✓
First curve correctly drawn as indicated	✓
Second curve correctly drawn as indicated	✓
Position at $t=2,89$ s (answer of Q3.5) = 5,84 m	✓

(5)

[17]

QUESTION 4

4.1



Accepted labels	
w	F_g / F_w / force of earth on block / weight / 29,4 N / mg / gravitational force
N	Normal force / F_N / Force of incline on block
F_T	Tension / T / force of rope / F
f	Friction / Kinetic friction / f_k / F_f

Notes:

- Mark is awarded for label and arrow.
- Do not penalise for length of arrows.
- Deduct 1 mark when more than 4 forces drawn.
- Deduct 1 mark if force(s) do not make contact with dot.
- If arrows missing/: Max $\frac{3}{4}$

(4)

4.2.1 Weight / Gravitational force / F_g

(1)

4.2.2 Weight of block R

(1)

4.2.3 Tension / Force in rope

(1)

4.3 The net/total work done on an object is equal to the change in the object's kinetic energy. ✓✓

ACCEPT:

The work done on an object by a resultant/net force is equal to the change in the object's kinetic energy.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

4.4 **OPTION 1**

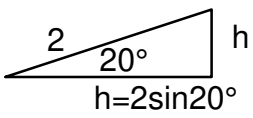
$$\left. \begin{aligned} W_{\text{net}} &= \Delta E_k \\ (W_{Fg})_P + (W_f)_P + (W_{Fg})_R &= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 \end{aligned} \right\} \text{Any one } \checkmark$$

$$\underline{(3)(9,8)\sin 20^\circ (2)\cos 180^\circ} \checkmark + \underline{(15)(2)\cos 180^\circ} \checkmark + \underline{(8 \times 9,8)(2)\cos 0^\circ} \checkmark = \underline{\frac{1}{2}(11)v^2 - 0}$$

$$v = 4,40 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(5)

OPTION 2

$$\left. \begin{aligned} W_{\text{net}} &= \Delta E_k \\ (W_{Fg})_P + (W_f)_P + (W_{Fg})_R &= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 \end{aligned} \right\} \text{Any one } \checkmark$$


$$\underline{(3)(9,8)(2\sin 20^\circ)\cos 180^\circ} \checkmark + \underline{(15)(2)\cos 180^\circ} \checkmark + \underline{(8 \times 9,8)(2)\cos 0^\circ} \checkmark = \underline{\frac{1}{2}(11)v^2 - 0}$$

$$v = 4,40 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(5)

OPTION 3

$$\left. \begin{aligned} W_{\text{nc}} &= \Delta E_k + \Delta E_p \\ (W_f)_P &= [\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2] + [mgh_f - mgh_i]_P + [mgh_f - mgh_i]_R \end{aligned} \right\} \text{Any one } \checkmark$$

$$\underline{(15)(2)\cos 180^\circ} \checkmark = \underline{[\frac{1}{2}(11)v^2 - 0]} \checkmark + \underline{[(3)(9,8)(2\sin 20^\circ) - 0]} \checkmark + \underline{[0 - 8(9,8)(2)]}$$

$$v = 4,40 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(5)

[14]

QUESTION 5

5.1 The distance between two consecutive points in phase on a wave. ✓✓

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

5.2 $v = f\lambda$ ✓
 $340 = 1\,520 \lambda$
 $\lambda = 0,22 \text{ m}$ ✓

(2)

5.3.1 $f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓
 $= \frac{340}{340+20} (1\,520)$ ✓
 $f_L = 1\,435,56 \text{ Hz}$ ✓

(3)

5.3.2 **POSITIVE MARKING FROM QUESTION 6.2.2**

$$f_L = \frac{v \pm v_L}{v \pm v_S} f_S$$

$$= \frac{340}{340-25} (1\,520) \checkmark$$

$$f_L = 1\,640,63 \text{ Hz} \checkmark$$

$\Delta f = 1\,640,63 - 1\,435,56 \checkmark = 205,07 \text{ Hz} \checkmark$

(4)

[11]

QUESTION 6

6.1

6.1.1 Gas ✓ (1)

6.1.2 C_nH_{2n+2} ✓ (1)

6.1.3 Increases ✓



Structure:

The chain length/molecular size/molecular structure/molecular mass /surface area increases. ✓

Intermolecular forces:

Increase in strength of intermolecular forces/Van der Waals forces/dispersion forces/London forces. ✓

Energy:

More energy needed to overcome (or break) intermolecular forces/
Van der Waals forces/dispersion forces/London forces. ✓

(4)

[6]

QUESTION 7

7.1 $2C_3H_8 + 10O_2 \rightarrow 6CO_2 + 8H_2O$ ✓ Bal. ✓ (3)

7.2

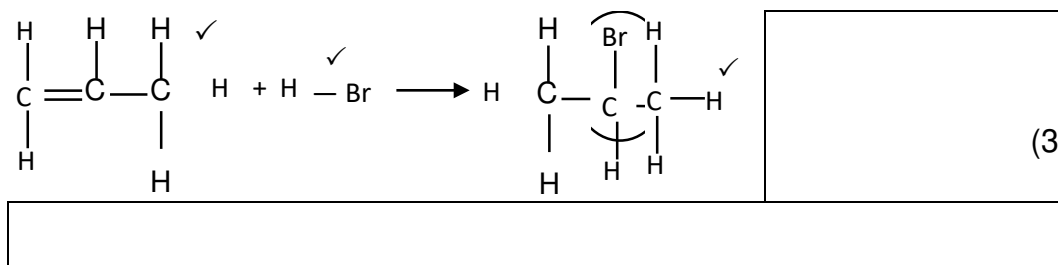
7.2.1 Elimination ✓ (1)

7.2.2 Addition ✓ (1)

7.3

7.3.1 Prop-1-ene/1-propene/propene ✓ (1)

7.3.2



- 7.4
- 7.4.1 Dilute (strong base) ✓ (Mild) heat ✓ (2)
- 7.4.2 propan-2-ol / 2-propanol ✓ (1)
- 7.5 $\text{H}_2\text{SO}_4/\text{H}_3\text{PO}_4$ ✓ (1)

[13]

QUESTION 8

8.1 ONLY ANY ONE OF

- Change in concentration of products / reactants ✓ per (unit) time. ✓
- Rate of change in concentration. ✓✓
- Change in amount / number of moles / volume / mass of products or reactants per (unit) time. (2)
- Amount / number of moles / volume / mass of products formed or reactants used per (unit) time.

8.2

- 8.2.1 Temperature ✓ (1)
- 8.2.2 Rate of reaction / Volume of gas (formed) per (unit) time ✓ (1)

- 8.3 • Larger mass / amount / surface area. ✓ (3)

More effective collisions per (unit) time. / Frequency of effective collisions increase. / More particles collide with sufficient kinetic energy & correct orientation per (unit) time. ✓✓

IF

- Larger mass / amount / surface area. ✓
- More particles collide. / More collisions. ✓ Max. $\frac{2}{3}$

Notes

IF

No reference to mass / amount / surface area in answer: $\frac{0}{3}$

8.4 Compare Exp.1 with Exp. 2: The reaction in exp. 1 is faster in exp. 1 than in exp. 2 due to the higher acid concentration. ✓ (6)

Therefore the gradient of the graph representing exp. 1 is greater / steeper than that of exp. 2. / Graph of Exp. 1 reaches constant volume in shorter time than exp. 2. ✓

Compare Exp. 1 with Exp 3 & 4: The reaction in exp. 3 is faster than that in exp. 1 due to the higher temperature. ✓

The reaction in exp. 4 is faster than that in exp. 1 due to the higher temperature / larger surface area. ✓

OR/OF

Graph A represents exp. 4 due to the greater mass of CaCO_3 - greater yield of CO_2 at a faster rate.

Therefore the gradient of the graphs of exp. 3 & 4 are greater/steeper than that of exp. 1. / Graphs of Exp. 3 & 4 reaches constant volume in shorter time than exp. 1. ✓

Final answer F C ✓

Notes

- Compare exp. 1 with exp. 2
 - Factor & rate
 - Gradient / volume CO_2 per time / gradient /
- Compare exp. 1 with exp. 3
 - Factor & rate
- Compare exp. 1 with exp. 4
 - Factor & rate
- Compare gradient / volume CO_2 per time of exp 1 with that of exp. 3 & 4

8.5 **Marking criteria**

- Divide volume by r : 25,7 ✓
- Use ratio : $n(\text{CO}_2) = n(\text{CaCO}_3) = 1:1$ ✓
- Substitute 100 in $n = \frac{m}{M}$. ✓
- Subtraction ✓
- Final answer : 7,00 g to/tot 7,5 g ✓

(5)

OPTION 1

$$\begin{aligned}
 n(\text{CO}_2) &= \frac{V}{V_m} \\
 &= \frac{4,5}{25,7} \checkmark \\
 &= 0,18 \text{ mol } (0,175 \text{ mol})
 \end{aligned}$$

$$n(\text{CaCO}_3) = n(\text{CO}_2) = 0,18 \text{ mol } \checkmark$$

$$\begin{aligned}
 n(\text{CaCO}_3) &= \frac{m}{M} \\
 0,18 &= \frac{m}{100} \checkmark \\
 \therefore m &= 18 \text{ g } (17,5 \text{ g})
 \end{aligned}$$

$m(\text{CaCO}_3)$ not reacted:

$$25 - 18 \checkmark = 7,00 \text{ g } \checkmark \quad (7,49 \text{ g})$$

(Accept range: 7,00 g – 7,5 g)

OPTION 2

Calculate mass of CO_2 :

$$\begin{aligned}
 n(\text{CO}_2) &= \frac{V}{V_m} \\
 &= \frac{4,5}{25,7} \\
 &= 0,18 \text{ mol } (0,175 \text{ mol})
 \end{aligned}$$

$$\begin{aligned}
 n(\text{CO}_2) &= \frac{m}{M} && \text{Ratio } \checkmark \\
 0,18 &= \frac{m}{44}
 \end{aligned}$$

$$\therefore m(\text{CO}_2) = 7,92 \text{ g } (7,7043 \text{ g})$$

$$\begin{aligned}
 m(\text{CaCO}_3 \text{ needed}) &= \frac{7,92}{44} \times 100 \\
 &= 18 \text{ g } (17,5 \text{ g})
 \end{aligned}$$

$m(\text{CaCO}_3)$ not reacted:

$$25 - 18,00 \checkmark = 7,00 \text{ g } \checkmark \quad (7,49 \text{ g})$$

(Accept range: 7,00 g – 7,5 g)

OPTION 3

$$25,7 \text{ dm}^3 : 1 \text{ mol}$$

$$4,5 \text{ dm}^3 : 0,18 \text{ mol} \checkmark$$

$$100 \text{ g} \checkmark : 1 \text{ mol}$$

$$x : 0,18 \text{ mol} \checkmark$$

$$x = 18 \text{ g}$$

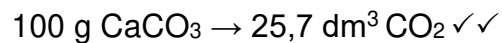


m(CaCO₃ not reacted:

$$\underline{25} - 18 \checkmark = 7,00 \text{ g} \checkmark$$

(Accept range: 7,00 g – 7,5 g)

OPTION 4



$$\therefore x = 17,51 \text{ g}$$



$$\text{Mass not reacted} = \underline{25} - 17,51 \checkmark$$

$$= 7,49 \text{ g} \checkmark$$

(Accept range: 7,00 g – 7,5 g)

[18]

GRAND TOTAL: 100